CLAIMS

What Is Claimed Is:

1. A three-dimensional molecular assembly, formed on a substrate, said molecular assembly comprising:

a first monolayer of seed molecules for initiating self-assembled molecular growth, said first monolayer formed on said substrate;

a second monolayer of active molecules comprising a plurality of rotor moieties and stator moieties, with one rotor moiety supported between two stator moieties, said second monolayer of active molecules formed on said first monolayer of seed molecules, with a one-to-one correspondence between molecules in said first monolayer and said second monolayer;

a third monolayer of spacer molecules, formed on said second monolayer of active molecules, with a one-to-one correspondence between molecules in said second monolayer and said third monolayer; and

a plurality of alternating second monolayers and third monolayers having said one-to-one correspondence.

2. The three-dimensional molecular assembly of Claim 1 wherein said seed molecules comprise at least one connector portion and an interconnecting portion.

3. The three-dimensional molecular assembly of Claim 2 wherein said seed molecules comprise two asymmetric connector portions, on opposite sides of said interconnecting portion.

4. The three-dimensional molecular assembly of Claim 1 wherein said active molecules comprise said rotor moieties and said stator moieties, and at least one connector portion connected to at least one said stator moiety.

5. The three-dimensional molecular assembly of Claim 4 wherein said active molecules comprise two connector portions connected to said at least one stator moiety, on opposite sides thereof to form a first connector portion and a second connector portion.

6. The three-dimensional molecular assembly of Claim 5 wherein each said connector portion has at least one functional group thereon, which is the same for said first connector portions and said second connector portions.

7. The three-dimensional molecular assembly of Claim 5 wherein said first connector portions each have at least one first functional group thereon, which is the same for all first connector portions and wherein said second connector portions each have at least one second functional group thereon, which is the same for all second connector portions, wherein said at least one first functional group is different than said at least one second functional group.

8. The three-dimensional molecular assembly of Claim 4 wherein not all stator moieties have any said connector portions connected thereto.

9. The three-dimensional molecular assembly of Claim 1 wherein said spacer molecules comprise at least one connector portion and an interconnecting portion.

10. The three-dimensional molecular assembly of Claim 9 wherein said spacer molecules comprise two connector portions, on opposite sides of said interconnecting portion.

11. The three-dimensional molecular assembly of Claim 10 wherein each said connector portion has at least one functional group thereon, which is the same for said first connector portions and said second connector portions.

12. The three-dimensional molecular assembly of Claim 10 wherein said first connector portions each have at least one first functional group thereon, which is the same for all first connector portions and wherein said second connector portions each have at least one second functional group thereon, which is the same for all second connector portions, wherein said at least one first functional group is different than said at least one second functional group.

13. The three-dimensional molecular assembly of Claim 1 wherein said substrate comprises a first electrode and wherein said molecular assembly further comprises a second electrode formed on an uppermost monolayer.

14. The three-dimensional molecular assembly of Claim 13 wherein said third monolayer is formed on said first monolayer, said second monolayer is formed on said third monolayer, with subsequent alternating third monolayers and second monolayers, with said second electrode formed on said uppermost monolayer.

15. The three-dimensional molecular assembly of Claim 13 wherein said seed layer is omitted, said second monolayer is formed directly on said first electrode, and said third monolayer is formed on said second monolayer, with subsequent alternating second monolayers and third monolayers, with said second electrode formed on said uppermost monolayer.

16. The three-dimensional molecular assembly of Claim 13 wherein said seed layer is omitted, said third monolayer is formed directly on said first electrode, and said second monolayer is formed on said third monolayer, with subsequent alternating third monolayers and second monolayers, with said second electrode formed on said uppermost monolayer.

17. A method for fabricating a three-dimensional molecular assembly, formed on a substrate, said method comprising:

forming on said substrate a first monolayer of seed molecules for initiating self-assembled molecular growth;

forming on said first monolayer a second monolayer of active molecules comprising a plurality of rotor moieties and stator moieties, with one rotor moiety supported between two stator moieties, with a one-to-one correspondence between molecules in said first monolayer and said second monolayer;

forming on said second monolayer a third monolayer of spacer molecules, with a one-to-one correspondence between molecules in said second monolayer and said third monolayer; and

forming a plurality of alternating second monolayers and third monolayers having said one-to-one correspondence.

18. The method of Claim 17 wherein said seed molecules comprise at least one connector portion and an interconnecting portion.

19. The method of Claim 18 wherein said seed molecules comprise two asymmetric connector portions, on opposite sides of said interconnecting portion.

20. The method of Claim 17 wherein said active molecules comprise said rotor moieties and said stator moieties, and at least one connector portion connected to at least one said stator moiety.

21. The method of Claim 20 wherein said active molecules comprise two connector portions connected to said at least one stator moiety, on opposite sides thereof to form a first connector portion and a second connector portion.

22. The method of Claim 21 wherein each said connector portion has at least one functional group thereon, which is the same for said first connector portions and said second connector portions.

23. The method of Claim 21 wherein said first connector portions each have at least one first functional group thereon, which is the same for all first connector portions and wherein said second connector portions each have at least one second functional group thereon, which is the same for all second connector portions, wherein said at least one first functional group is different than said at least one second functional group.

24. The method of Claim 20 wherein not all stator moieties have any said connector portions connected thereto.

25. The method of Claim 17 wherein said spacer molecules comprise at least one connector portion and an interconnecting portion.

26. The method of Claim 25 wherein said spacer molecules comprise two connector portions, on opposite sides of said interconnecting portion.

27. The method of Claim 26 wherein each said connector portion has at least one functional group thereon, which is the same for said first connector portions and said second connector portions.

28. The method of Claim 26 wherein said first connector portions each have at least one first functional group thereon, which is the same for all first connector portions and wherein said second connector portions each have at least one second functional group thereon, which is the same for all second connector portions, wherein said at least one first functional group is different than said at least one second functional group.

29. The method of Claim 17 wherein said substrate comprises a first electrode and wherein said method further comprises forming a second electrode on an uppermost monolayer.

30. The method of Claim 29 wherein said third monolayer is formed on said first monolayer, said second monolayer is formed on said third monolayer, with subsequent alternating third monolayers and second monolayers, with said second electrode formed on said uppermost monolayer.

31. The method of Claim 29 wherein said seed layer is omitted, said second monolayer is formed directly on said first electrode, and said third monolayer is formed on said second monolayer, with subsequent alternating second monolayers and third monolayers, with said second electrode formed on said uppermost monolayer.

32. The method of Claim 29 wherein said seed layer is omitted, said third monolayer is formed directly on said first electrode, and said second monolayer is formed on said third monolayer, with subsequent alternating third monolayers and second monolayers, with said second electrode formed on said uppermost monolayer.